Please note: The authors have reported that they have no relationships relevant to the contents of this paper to disclose. Jonathan Tobis, MD, served as Guest Editor for this paper.

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REPLY: Musculoskeletal Pain and Cancer Risk of Staff Working With Fluoroscopically Guided Procedures

We greatly appreciate the interest of Dr. Fan and colleagues in our recent study published in the *Journal* (1). We reported that hours per week involved in radiation-utilizing procedures and time per week wearing the lead apron were associated with increased musculoskeletal pain. It was suggested by Dr. Fan and colleagues that we analyze these factors using cumulative lifetime values (time per week × years in profession). We did not perform the analyses in the original paper because of concerns on variations in the weekly time spent by the operators over the course of their careers. However, we have performed the requested analysis.

As expected, employees participating in radiation-utilizing procedures who reported musculoskeletal pain had more hours of lifetime participation (6,240 h vs. 2,002 h; $p < 0.001$) and hours wearing the lead apron (1,950 h vs. 559 h; $p < 0.001$). There was a small, significant correlation between total time wearing the lead apron and the objective pain rating index pain score in patients not taking pain medication (Spearman $r = 0.178$; $p = 0.002$). Nurses reported more musculoskeletal pain than physicians and correspondingly had more lifetime hours of procedural participation (6,578 h vs. 2,704 h; $p < 0.001$) and more hours wearing the lead apron (4,940 h vs. 2,652 h; $p < 0.001$). Technicians also reported more pain than physicians and had higher lifetime hours of participation in radiation-intensive procedures (4,680 h vs. 2,704 h; $p < 0.001$) but wore the lead apron less (572 h vs. 2,652 h; $p < 0.001$). We believe that these additional data confirm our previous assertions that time per week involved in interventional procedures and use of the lead apron are associated with increased musculoskeletal pain in the catheterization lab. However, given the difference in lead apron use among physicians and technicians, additional factors may be involved as we described in the discussion of our paper (patient transfers, sheath pull, less rotation out of the catheterization lab, and so on).

Fan and colleagues also suggested that our comparison of cancer prevalence among interventional laboratory employees compared with noninterventional lab employees be stratified by working years. Our original paper reported no difference in years in current profession among the study or control group ($p = 0.81$), which is why we did not assess associations with cancer history stratified by working years. The stratified analyses suggested by Fan and colleagues also did not detect any difference in cancer prevalence between the 2 groups among employees working 0 to 5 years ($p = 0.7$), 6 to 10 years ($p = 0.5$), 11 to 15 years ($p = 0.3$), 16 to 20 years ($p = 0.4$), or >20 years ($p = 0.8$). The overall Cochran-Mantel-Haenszel p value was 0.78. We continue to acknowledge the limitations of our cross-sectional design and the need for large, longitudinal studies of employees exposed to radiation.

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